

August 28, 2001 CEC PIER Strategic DER Workshop Audience Comments from Current World Session

Interconnection

1. S.C. Bhatt (EPRI): Problem is integration (\$600K project for testing underway). There are different perspectives and priorities.
2. Joe Iannucci (Distributed Utility Associates):
 - a) Operational issues: when, where, how?
 - b) Planning methods
 - c) Benefits maximization
 - d) Storage (dispatch strategy)
3. Ross Fernandes (Southern California Edison) : Integration and dispersed storage
 - Reliability
 - Response Characteristics
 - Impact on transmission
4. Rita Norton (SVMG): Increase stakeholder involvement. Get institutional representatives to review and assist with barriers. Engage institutional barrier representatives as stakeholders in standards development.
5. Dan Rastler (EPRI):
 - How much DER is considered substantial? Are we talking Gigawatts? 20% of total generating capacity? The quantity in question will drive the nature of projects.
 - What is the time horizon? 5-10 years or 10-20 years?
 - Defining these items will help in prioritizing strategies
6. Richard Ely (ADM Associates): Top-down approach is being assumed. Assume distributed control. If islanding is considered part of the system, the whole approach would change. That would be a real game changer.
7. Edan Prabhu (Reflective Energies): Look at the fuels. What are the benefits and downsides?
8. Chris Marnay (Berkeley Lab): CHP technology and societal benefits need to be made more explicit. Integrate CHP concerns into system design.
9. Fred Schwartz (AFS Trinity): Distinguish between utility grade interconnection and industrial grade interconnection for low-cost interconnect.
10. Richard Ely (ADM Associates): Plugging in a generator should be more economical than a load of the same size.
11. Susan Gardner (ABB): Economics make things difficult. California is subsidizing the utilities right now so the market is not equal. A level playing field is needed.

Grid Impacts

1. Ted Bronson (GTI): Can we quantify the benefits to the grid?
2. Ed Vine (GIC/CIEE): Why not do a bottoms-up analysis to see what customers want and penetration?
3. Robert Wichert (US Fuel Cell Council): Do site-specific studies rather than generic, unnecessary ones.
4. Joe Iannucci (Distributed Utility Associates): How do these things interact in real-time? Is there a limit to the amount of DG on the grid? Maybe 30%? Dynamic versus a static answer.
5. Jim Skeen (SMUD): More tools to assess modeling impacts are needed...for many sources rather than just 1 or 2.
6. Rita Norton (SVMG): Forecast for the grid after 10-20 years to address meeting demand of the future.
7. Chris Marnay (Berkeley Lab) : Think of a more decentralized power system. Can the power system or the expansion thereof be built around microgrids?
8. Gary Nakarado (NREL): There is a status quo bias where the utility decides. Politics need to be discussed to find out what is in the public interest.
9. Mike Iammarino (San Diego Gas and Electric): Not enough test information is available on the interaction between the power system and DER.
10. Catherine Mohr (Aerovironment): The effect of storage on grid impacts is significant.

Market Integration

1. Name Not Available: Timeline for role and purpose of grid (to see how its role changes)
2. Rita Norton (SVMG): High reliability requirements
 - Can that be reflected?
 - Market integration would be where it belongs
3. Dave Hawkins (CAISO): Dispatching for environmental reasons
 - market credits
 - look at it from an environmental perspective
4. Ron Hoffman (RHC): Baseline the system below substation to understand what is the market. With baseline, the benefits can then be calculated.
5. Bob Yinger (Southern California Edison): What does the customer want? CHP? Premium power? At what price?
6. Richard Ely (ADM Associates): Look at where the risk flows
 - Risk assignment
 - Risk analysis in strategic planning
 - Storage as a buffer, particularly for wind and solar (CA is encouraging more renewables)
7. Name Not Available: Look at storage as an enabling technology
8. David Hawkins (CAISO): A task force to look at market rules for intermittent power may be needed along with new tariffs.
9. Richard Ely (ADM Associates): Show stoppers are institutional in nature.
10. Dan Rastler (EPRI): A pilot program for market participation may be helpful to develop market participation mechanisms
11. Name Not Available: Examine power quality in the digital world.
12. S.C. Bhatt (EPRI): Resources are limited and those limitations will drive which items get addressed.

August 28, 2001 CEC PIER Strategic DER Workshop Potential Roles and Priorities for DER RD&D (Positive Changes for R&D)

INTERCONNECTION

Q: Is the 80/20 rule applicable to DER interconnection (i.e., 20% of effort yield 80% of returns)?

Joe Iannucci: (No) The answer would be “yes” if we knew what is the right area to research. But we’ve only seen the tip of the iceberg, so “no”.

Tom Dossey: (No) I agree with Joe. Simple interconnection rules need to be built upon. Option of selling and exporting power needs to be expanded.

Scott Castelaz: (No) It is still early in the game, much like the transition from mainframe computers to PCs in 1982. Significant work needs to be done.

Wade Troxell: (No) DG is still flying blind. Information networks need to be developed.

Audience: Is standby power & price/reliability charges the correct path to take?

Joe Iannucci: It is too early and immature to tell.

Tom Dossey: Work is being done and utilities are balancing charges, but it is still early.

Q: What are the customers’ biggest concerns involving interconnection?

Dan Rastler: 1) Customers are not educated and don’t want to be bothered, 2) would like to see closure on IEEE standard development and 3) energy provider should take care of interconnection issue

Chris Marnay: Customers ask what are the benefits and at what cost

Joe Galdo: Unnecessary requirements and delays in processing request

Joe Iannucci: Environmental issues

Audience: Are standards ready to be applied in the field?

Dan Rastler: Yes, it’s being done in field tests.

Tom Dossey: IEEE isn’t ready, but efforts are underway using existing standards. The number of units out there is still not sufficient.

Audience: Are results good?

Tom Dossey: Minimum standards have been met.

Q: What are the next steps for CEC on standards?

Wade Troxell: **Encourage market development.** In a true market, customer oriented entities will provide products of great value.

Scott Castelaz: Create value, not so much a technology issue. **CEC should focus on making things simpler.**

Joe Galdo: **Lots of testing and validation remains to be done;** IEEE addressing networks in a minimal way and CEC may work on that a little more

Dan Rastler: Education for end users with a platform to inform stakeholders of good, bad and the ugly.

Network Issues need to be addressed and R&D is needed.

Audience: Anything that CEC could do to encourage 1547 would be appreciated.

Audience: What about islands as a system of design?

Chris Marnay: More research into positives and negatives is still needed to understand how to deal with islands

Tom Dossey: We are putting together a microgrid at a university, but we’ll need regulatory changes to go along with the technology.

Joe Iannucci: Islanding shows the good and bad side of DER, but no one is looking into the central station concept. We’re not ready for beneficial islanding.

Chris Marnay: We need to make a system that makes sense from an EE perspective and prevent unintentional islanding.

Q: How effective are strategies to reduce costs? How should CEC participate?

Wade Troxell: Benefits and costs become clear from large projects...perhaps a **large scale pilot involving 1,000 to 1,500 units** would reveal true benefits.

Joe Galdo: Long term approach would help guide CEC.

Dan Rastler: There's a lot of work from large companies, but the **CEC could help sponsor a pilot to drive a large-scale project.**

Joe Iannucci: The free market will take care of hardware development.

Dan Rastler: **Type testing is still needed.**

Audience:

-No one can optimize the grid properly right now.

-Pilot testing in a field experiment involving transitional controls is needed.

-Look to off-shore rigs and military DER that may provide insights into civilian DER.

-If pilot projects go through RFP, they may not be responsive to customer needs. Establish entity that provides monetary resources to customers to expand DER usage.

GRID IMPACTS

Q: What is the next logical step for microgrids?

Tom Dossey: We utilities have not used DER significantly, but we're doing research in microgrids with UCI. Regulatory issues become complicated when there are multiple end user entities on a microgrid.

Scott Castelaz: Some universities and mining operations are already like small grids; **pilot testing is needed**

Dan Rastler: We're trying to understand microgrids and how it complements the existing infrastructure. We need to see if it could be a new model to serve the digital economy. **Getting a coordinated effort together is a major gap.**

Chris Marnay: Existing demonstrations are built on local needs. Look at the fundamental economics of what a microgrid is. Lots of projects in microgrids are trying to meet local needs. **Microgrids are very appropriate candidates for CEC assistance.** CHP is a key economic driver. Look at the **social science aspect such as noise pollution** (not found in draft report).

Audience: Impacts have negative bias. Begin to define where the benefits are.

Joe Iannucci: **We don't have good models and data for benefits.** Don't call them impact or benefits, but call it effects.

Wade Troxell: More system modeling on intelligent grid is needed.

Tom Dossey: We must distinguish between premium power vs. cobbling together some DER (grid effects)

Joe Iannucci: Of course there are benefits, but more modeling and data is needed.

Audience:

-Wind power and storage cannot be ignored.

-There is an interest in high quality, inexpensive power with low environmental impact, so multiple pilot studies will be helpful.

Q: If CEC could only fund grid impacts, where would you put your money?

Scott-Have to home in on what Chris said earlier about microgrids.

Audience: Microgrids vary dramatically, so **categorizing them or defining them is meaningless.**

Q: Are there any missing gaps?

Tom Dossey: I tend to be more in favor of **education and consumer advocacy.**

Q: What is the role of a distribution company?

Tom Dossey: Anything and everything...**particularly a facilitation role.**

Joe Iannucci: DUIT is trying to answer a lot of these questions of diverse DER interacting with each other and the grid.

Joe Galdo: There isn't one distribution system out there...testing and validation is needed.

Audience: Power quality should be examined.

Joe Iannucci: We are doing it in DUIT.

Audience: Congestion doesn't seem to have been a focus so far.

Stan: It is addressed in market integration, but perhaps we may also include it in the grid impact section.

MARKET INTEGRATION

Q: Grid side benefits are:

- a) a red herring
- b) limited to exceptions
- c) substantial
- d) none of the above

Wade Troxell: c) substantial; grid constraints can be significantly reduced with DER; DER fundamentally enhances the grid

Joe Galdo: potentially substantial benefits since there are still many if's...may require grid redesign

Scott Castelaz: potentially substantial benefits; many things need to be addressed

Q: Are grid side benefits

- a) difficult to monetize and not worth the effort
- b) impossible to monetize and not worth the effort
- c) difficult to monetize but critical to DERs success
- d) none of the above

Dan Rastler: They are **difficult to monetize but critical to DER's success**. One utility is trying to quantify the benefits. Small gas turbine supporting transmission might be appropriate.

Tom Dossey: Gas turbines can be a temporary solution. Some may not define 20 MW as DER.

Chris Marnay: **Installation of microgrids will reveal the benefits**. The benefits are found where the system is growing. Microgrids make you think about both sides of the coin.

Joe Iannucci: Grid-side benefits are exceptions but frequently occur. Portability and storage are some benefits.

Audience: Has DG been targeted geographically in CA?

Chris Marnay: GIS is perfect for this and identify where benefits can be found

Joe Iannucci: You need to know where you're overbuilt; uncertainty of the growth

Audience: Isolated load centers such as SF would be very interested.

Audience: Central Business Districts (CBDs) have generally been excluded from DG benefits.

Dan Rastler: Networks in these areas are prevented from 2-way power flow and are barriers to DER adoption.

Audience: We need to understand the time and location impact of power quality and outage.

Audience: Grid regulations could be modified to allow for better DER participation

Q: How important is it for DER to participate in wholesale power markets?

Chris Marnay: CA has bracketed the problem, **small DER's low voltages won't make them effective in the bulk power markets** (skeptical)

Joe Iannucci: Less skeptical than Chris; **people will sell their excess power if they can**

Wade Troxell: Part load curtailment and part export is being done.

Chris Marnay: Autonomous agents modeling could be an opportunity.

Q: How important are the enabling technologies? Are they appropriate for public funding?

Scott Castelaz: **Collaboration and competition is good.** These technologies are important.

Wade Troxell: This is a critical area. There can be a large number of participants. Costs will be driven down. Large-scale demonstration effort is recommended.

Tom Dossey: **Communication and monitoring is needed if DER is going to be significant.**

Wade Troxell: Intelligent equipment allow for **less scaling needs at control points.** It's an application but not demonstrated on a large scale.

Audience:

-How we put together the building blocks is a key area to explore. It's the application of existing technology.

-California is behind in DER because it has too much regulation.

Q: Where do you think the CEC should play a role in market integration?

Dan Rastler: **Creating a platform where market integration is core...** maybe a pilot for how DER participates in the market. One on one customer programs.

Joe Galdo: I agree with the draft report chart for this area in terms of where CEC can play a role; an **assessment of tariffs and rates is also needed**

Chris Marnay: Environmental questions haven't come up much.

Audience: consumption of methane should be considered

Joe Iannucci: I need to know **where the playing field is in economic, environmental, and regulatory terms.**

Wade Troxell: Its an informational network...**control at the unit and global/aggregated level are all issues**

GENERAL QUESTIONS

Q: What can be done to make working with the CEC more attractive?

General response: This is a tough question to answer.

Q: What should be the priorities for CEC?

Scott Castelaz: 1) Regulatory process, 2) protocols for aggregating and communicating with ISO, 3) field testing 1547, 4) heterogeneity of microgrids

Joe Iannucci: 1) Sharpen the concept of benefits and quantify them, 2) leveling the playing field, 3) play a leadership role and leverage it to get more partners

Joe Galdo: 1) support implementation of IEEE interconnection standard, 2) look at tariffs and rules to get benefits back to owners of DG, 3) playing field: what does it look like

Chris Marnay: 1) find the benefits, 2) testing (e.g., environmental impacts), 3) CHP and control system

Wade Troxell: 1) value-stream identification and measurement technologies, 2) smart communication and interface, 3) large-scale pilot demonstration

Tom Dossey: consumer incentives and education

Dan Rastler: 1) applications (T&D grid support, CHP premium power), 2) CHP, 3) premium power; CEC should integrate programs with national coordinated activities

Audience:

-Talk about premium power suggests that some people will get low quality power.

-Hands-on field testing for DG impacts to validate models.

-Become as coupled as possible with consumer-based efforts by assisting with engineering or \$

-Support use of DG that doesn't qualify on a commercial basis

-Support IEEE 1547 as CA standard

-Improve understanding of benefits from location and availability based on pilot.

-Continue support for technology development

-Increase funding support.

-Support enabling technologies, including storage.

August 28, 2001 CEC PIER Strategic DER Workshop Top Potential Changes that Could Impact DER (Game Changers)

Group 1

Facilitator: Robert Shelton

- Energy Internet (energy transactions)
- Distributed control networks (autonomous control)
- Ubiquitous plug and play DER (plug into grid)
- Complete redesign of grid into bi-directional system
- Real-time marginal pricing (location-based)
- Energy star type compliance for DER (system level engineering)
- Motor vehicles integrated into grid
- 10% DER portfolio mandate for California (10% of all power in CA must be from DER)
- CEC support for pilot microgrid project
- Large scale support for storage technologies

Group 2

Facilitators: Jose Luis Contreras / Warren Wang

- Universal certification standards for interconnection and environmental performance
- Address (ratify or reject) outstanding policy issues-(e.g., clarify rules for participation in DER markets)
- DMV-like entity for home/small scale applications for DER (one-stop shopping for approval)
- Streamline the regulatory process
- Focused research on transition from centralized to decentralized power

Group 3

Facilitator: David Walls

1. Standardize interfaces of grid interconnection
2. R&D should be market value driven
 - based on real-time pricing
 - research on playing field: regulatory, economic, environmental
3. R&D into distributed control across all levels such that it is less top-down (e.g., virtual grid)
4. Selling DG back to the balancing authority – services (ancillary, voltage support, etc.)

Other Ideas

- More focus on cooling CHP
- Focus on demonstrations and pilot programs
- Create clear market penetration targets – geographic, timing, types, etc.
- R&D into reliability and power quality in terms of customer needs, market value...etc.
- Science of Demand Side Management (DSM)/ DG/ CHP – optimization at facility level

Group 4

Facilitator: Stanley Blazewicz

- Moratorium on pollutants such as CO₂ (e.g., Kyoto Accord)
- Digital society needs (e.g., power quality)
- Assign dollar values to DER related items such as environmental impact, reliability, and cost
- True real-time pricing
- Pricing signals for reliability

August 28, 2001 CEC PIER Strategic DER Workshop
Game Changers-Group 1
Facilitator: Robert Shelton

Mental Model

Large scale
Revolutionary
Systemic
Out of box
Change of authority (control of power)
Necessary
Futuristic-forward looking fundamental shifts
 Starts today → Future impacts
Market enablers
Super fast-tracking
Disruptive
Leadership
Results-fast (Lower risk of R&D)
New direction of technology
New market structure
Bottom-up control instead of top-down
Paradigm shift

Brainstorming Ideas

- Distributed generation requires decentralized utilities (control)
- From aerobic to anaerobic (water management)
- Energy Internet (energy transactions) financial, contractual
- Islanding as an element of design (now anathema)
- All regulated investments accomplished by outsourcing (market based or led)
- Commissions understand benefits
- Removing utility controls
- Many networks-devices, informational
- Distributed control networks (autonomous controls)
- Intelligent devices
- Choice vs. programs
- Ubiquitous plug and play (plug into grid) DER
- More information on devices (readiness, dispatchability, location, pedigree)
- Intelligent cooperative power centers, internet model.
- Redesign better bidirectional power system
- Real-time marginal pricing
- Integrated information flow bottom-up and top-down
- Liability and risk management (change the model). Local Liability? Utilities not responsible for what is in the wires.
- Telco analogy: separate content from wires
- Individual responsibility
- Highest EE end use responsibility (regulation); Mandated high efficiency standards; Ultra-low emissions; Environmentally friendly power sources; High quality power
- Whole system engineering – Energy Star Distributed Power
- Individual choice on all issues and responsibilities
- All distribution systems totally automated
- Equiv. of manufacturing plant
- Motor vehicles integrated into grid
- Proper large scale funding
- Outside force that change energy supply (e.g., global warming)
- Game changer that voids current contracts being signed
- CEC mind-shift regarding DER leverage from Technology to Policy
- Nationally coordinated agenda for DER
- Completely redesigned infrastructure for bidirectional power flow
- No new transmission lines
- Avoiding transmission constraints through DER
- Local retail wheeling
- Develop one integrated standard for interconnect (national standard)
- Different levels of performance based rate-making and give right to do it myself
- Integrated aligned industry
- Shift responsibility for power quality to customer (including choice)
- Apply riparian rights to electricity
- 10% renewable DER portfolio mandate
- Standardized air quality regulations throughout the state
- Minimal performance levels (mandated)
- Support pilot microgrids (CEC)
- Include megawatts as DG (megawatt exchange or hub)
- Mandated minimum criteria for DER
- Large scale support for storage

August 28, 2001 CEC PIER Strategic DER Workshop
Game Changers-Group 2
Facilitators: Jose Luis Contreras and Warren Wang

Desired Outcomes

- Faster commercialization
- No need to connect to utilities
- Large % of DG in the power generation mix
- No additional money to operate the grid
- Elimination of subsidies
- Creation of market for DER power
- Decentralization of control
- Reduced environmental impacts
- Plug and play interconnection
- Increased penetration of renewables
- Reduced costs
- Logical ownership structure for generation

Mental Model

- Grid infrastructure is based on central power
- Siting and permitting issues (economics don't make sense)
- Land use planning process
- Economies of scale is important
- Variations of environmental review based on the size of DER being installed
- Electric system stability under 4 operating conditions: peak shaving, grid isolation, net exporter and merchant
- In a free market, investors demand rapid return on investment, which may play against DER becoming more widespread
- Customers are looking for simplicity and do not wish to become experts
- Implementation of DER is not widespread
- A community among DER electricity producers doesn't exist

Brainstorming Ideas

- Remove the ability of companies to deduct gas and electricity expenses from federal and state taxes that are essentially acting as a subsidy
- Pilot project with a participant in an area of California that is experiencing a lot of pain with a negative impact on small users nearby
- Universal certification standards for interconnection and environmental performance
- Penalty taxes for pollution that exceed acceptable levels
- Common communication protocol
- More market research to understand consumer preferences
- Incentives for small commercial DER
- Address (ratify or reject) outstanding policy issues-(e.g., clarify rules for participation in DER markets)
- Streamline the regulatory process
- Protect the ratepayer so they are not penalized for growth in DER resulting in a shrunken user base relying on traditional utility supplied power
- Standardize the process of how standards are created
- Transaction forum or market for DER power
- Centralized monitoring with decentralized control
- DMV-like entity for DER installation in homes and small scale use that offer one-stop approval
- Look to Europe (e.g., Netherlands) for model of separation between distribution from generation
- Public education program for the those who wish to sell DER power and potential users
- Focused research on the what is needed for a transition from centralized to decentralized power and identifying what are the consequences

August 28, 2001 CEC PIER Strategic DER Workshop
Game Changers-Group 3
Facilitator: David Walls

Definition of Game Changer Idea

- Free energy storage
- Mother of invention
- End run around obstacles
- Fear and crisis (as an incentive)
- New perspective-customer centric
- Rethinking public utilities as primary source
- Value proposition-quick return on investment
- Cell phone-interconnection
- PCs as an example
- Blank paper-redesign of the power grid
- Services for sale and customer choice vs. obligation to serve
- Remove obstacle to goals (new strategies)

Mental Models

- Utility-centric views
 - Standard view of DER as a problem, not as a benefit
 - Universal quality of service
 - Entrenched utility accounting system
 - Averaging of power prices, services, etc...
 - Working solution through reverse engineering
 - What is the grid?
 - What does it take to handle bi-directional power flow?
 - Status quo cost
 - Joint energy system optimization
 - Increased DER
 - Power “gridlock”-create controls
- Public places for demonstrations (state facilities)

Brainstorming Ideas

- Identify target goals for DER penetration around geography or time frame, custom types, etc.
- Easy relocation of DER to optimize applications for industrial and society needs
- DER selling service back to balancing authority (ancillary service, voltage support)
- Research reliability and quality in terms of customers and markets
- Research study on the “playing field” (we don’t currently understand it): economic, regulatory, and environmental
- Virtual grid-power generation, distribution without lines
- Science of Demand Side Management/DER/CHP – all together
- R&D becomes market-value driven and real-time pricing drives R&D needs
- Integrate CHP into building design
- DER is “parasitical” in society
- More distributed control across all levels (less top-down control)
- Standardization of macro/micro grid interconnection and standardize interfaces
- Focus on demonstrations/pilots
- Energy system optimization at the facility level
- Energy system optimization at society level
- Research into aggregation of unique customers as well as suppliers (e.g., wind, solar)
- Virtual grid designs

August 28, 2001 CEC PIER Strategic DER Workshop
Game Changers-Group 4
Facilitator: Stanley Blazewicz

Mental Model

- Existing tariffs (fixed price/kWh) does not allow DG to be paid for real value
- There are no existing tariffs for different levels of reliability
- Ability to move/flexible reliability
- Lack of grid flexibility and economic communications
- Utilities not motivated for DER
 - Driven by kW passed through
 - Incentives counter to DER
 - In the driver's seat
- Varied market-dynamic; technical (3rd World) vs. regulatory (U.S.)
- Lack of cost-effective and environmentally benign DER
- Lack of clean fuel infrastructure
- Lack of good operational data to assess environment, economic benefit, and customer risk
- Must consider systemic impacts (diesel trucks and diesel DG)
- Separation of critical and non-critical loads + non-critical loads + communication system implications (can be interactive, real-time, etc.)
- Existing power system problems may be short-lived and be resolved by solutions other than DER

Brainstorming Ideas

- Digital society needs such as power quality
- Monetize other DER values such as environmental impact, reliability and cost
- Absolute deregulation with an open market where anyone can buy or sell – a free for all
- Move to total system design and develop technologies to improve CHP and other waste heat recovery
- Regulatory change and revised tariff to accommodate CHP
- Address export power regulations
- Develop DER that can determine all incentives and benefits based on location (zip code)-self optimization
- BTU Bank – convert natural gas to electricity and electricity to e-storage (e.g., H₂)
- Incentives and disincentives based on benefits achieved and impacts avoided
- True real-time pricing
- DER ISO
- Pricing signals for reliability, T&D constraints, environmental incentives, T&D stability, and ancillary services
- Lower grid reliability to minimum requirement and let customers that need high reliability pay for it
- Moratorium on construction of central power plants >50 MW
- Moratorium on pollutants such as CO₂ (e.g., Kyoto Accord)
- Lots of cheap nuclear power → need for storage
- Development of clean fuel infrastructure (e.g., LNG, H₂)
- Better understanding of power markets by customers and ease of participation
- Help customers understand problems to be solved

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